DETAILS OF THE WEATHER OF THE MONTH IN THE UNITED STATES.

CYCLONES AND ANTICYCLONES.

By A. J. HENRY, Meteorologist.

The tracks of 14 primary and 8 secondary cyclones have been plotted on Chart III. The great majority of these were without distinguishing features. The movement in latitude was more widely distributed than usual and there was an apparent lack of stability in most of the cyclones, as evidenced by the large number of secondaries that developed in the Rocky Mountain and Plateau region; also in the Northern Appalachian region. There was also a distinct tendency on the part of the cyclonic systems to assume the trough form east of the Mississippi. The track of cyclones plotted as III Ba and III Bb represent storms of widespread precipitation—snow in the mountains and rain in the lowlands. Near the close of the month a cyclonic system centered over southwest Arizona was apparently prevented from moving northeast by the pressure distribution over the plateau region. As it lingered over Arizona, flood-producing rains fell over that State, the first for several years. This cyclone finally moved east-southeast and appeared to dissipate over the mouth of the Rio Grande on the 25th. A few days later a fresh cyclone developed over Oklahoma and moved rapidly to the Lake Region as a storm of considerable energy. See track XIV.

Anticyclones.—Thirteen anticyclones have been plotted on Chart II All of these first appeared on the daily weather maps west of the 95th meridian, and like the cyclones a number of them dissipated before reaching the Atlantic. The Western Plateau region was occupied by an anticyclone from the 13th to the 18th and again from the 21st to the 23d. The southeastward movement of anticyclones was a feature of the month; four of the total number reached the Gulf States and apparently dissipated there. The movement of both cyclones and anticyclones during the month was more diverse than usual.

THE WEATHER ELEMENTS.

By P. C. DAY, Climatologist and Chief of Division.

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PRESSURE AND WINDS.

The early part of the first decade of the month had pressure values generally below normal, particularly toward the south and east. No decided storm centers were apparent, however, until about the middle of the decade, when a low area that had moved eastward across the Great Lakes probably combined with another that apparently developed off the New Jersey coast and by the morning of the 5th appeared as a severe storm near the Massachusetts coast, with low barometer readings and high winds from New Jersey to Maine. This storm slowly dissipated eastward, strong winds continuing for a day or two along the New England coast.

The latter part of the decade had strong high pressure over northern districts, with low pressure in the South, the latter developing into a well-defined storm that had moved northward and was central at the end of the decade in the upper Mississippi Valley. This storm was attended by heavy rains in the central valleys and by snows to the north and west of the center, the falls being particularly heavy in portions of eastern Colorado and western Nebraska. Early in the second decade high pressure overspread the Northwest and cold weather for the season prevailed for several days over most districts, the temperature falling to 20° below zero at points in Wyoming, and to freezing, or lower, in the interior of the Gulf States. Moderate pressure prevailed during the remaining portion of the second decade, but with a rising tendency, so that by the end it was well above normal over most eastern districts and high and rising to westward of the Rocky Mountains.

Pressure continued high in the West for several days, but in the East it rapidly gave way, and by the middle of the last decade pressure was low and falling from Texas northeastward to the lower Lakes and stormy conditions prevailed for several days over the eastern and southern districts, with heavy precipitation in the central valleys. At the same time high pressure was advancing into the upper Missouri Valley, the barometer reading at Havre, Mont., rising above 31 inches, the highest ever observed at that point. Low temperatures prevailed over all northern districts for several days, extending southward and westward over the Plains and Mountain districts, where the lowest temperatures for the month were generally observed. Near the close of the month pressure had fallen over central and eastern districts and a storm of wide area, attended by rain or snow, moved during the last two days from Texas northeastward to the Lower St. Lawrence Valley. At the same time high pressure and cold weather were again advancing into the Northwest.

The average pressure for the month showed the highest area extending as usual from the South Atlantic States northwestward to the northern Rocky Mountain and Plateau regions, with the maximum pressure, 30.20 inches, sea level, over central Wyoming. Pressure was lowest over the far Southwest, where the negative departures from the normal were likewise the greatest. The average pressure was above normal in southern Canada and generally over the northern and central portions of the United States, but in the most southern sections the averages for the month were less than normal.

November was a month with more wind than is usual over extensive areas, in fact several stations report the wind movement as greater than in any previous November. Winds were especially high and damaging at points on the New England coast on the 5th and 6th and in the vicinity of western Lake Erie on the 29th and 30th, where they were as high as, or higher than, ever before observed. The prevailing wind directions were mostly north to west along the Atlantic and Gulf coasts and over much of the interior of the country. In portions of the Ohio Valley and the Lake region they were frequently from the south or southwest and these directions prevailed extensively in the far Northwest.

TEMPERATURE.

November opened with unseasonably high temperature in the Ohio Valley and thence southeastward, but from the upper Lakes westward and southwestward cold weather for the season prevailed.

During the next few days considerably colder weather overspread the Atlantic Coast States, with frost from Virginia northward and in the Ohio Valley, and there was a general rise in temperature over most western districts, except that it was much colder in the Dakotas and adjacent States on the 4th. During the latter half of the first decade cool weather for the season prevailed in the Plains region and thence westward, but the daily

changes were usually not marked, and moderate temperatures were the rule in the central and eastern districts, some of the highest readings of the month being reported on the 9th and 10th in the central valleys. Early in the second decade, cold weather overspread nearly all portions of the country, the temperature falling to 20° below zero in Wyoming, and to freezing in the interior of the Gulf States. The latter half of the second decade was without marked temperature changes, but with a general tendency to warmer weather, although over much of the country the temperatures were frequently below normal. During the early part of the third decade moderate temperatures occurred in extreme eastern districts, but elsewhere important changes were infrequent and on the whole moderate weather prevailed. About the middle of the decade a severe cold wave overspread the Missouri Valley and during the following few days extended over much of the country. The lowest temperatures for the month were reported in the northwest, and far western States, but in the south and east the temperatures were not so low as on previous dates. The month closed with cold weather for the season over most southern districts, and a moderate cold wave was advancing into the Missouri Valley.

For the month as a whole the temperature averaged much below normal in the Missouri Valley and adjacent districts, and somewhat below over the remaining districts to westward of a line from central Texas northeastward, to the upper Lakes. The month was warmer than normal from the central and lower Mississippi Valley eastward and northeastward. Over portions of the upper Missouri Valley and northern Rocky Mountains November was far colder than normal, and following the unprecedented cold of October completed an autumn of unusual severity. On the other hand, over the southeastern States, November was unusually warm, in fact at some points it was the warmest November in nearly fifty years, and this following the unprecedented heat of October and above-normal temperatures for September constituted an autumn of unusual warmth.

Maximum temperatures about the first of the month were unusually high along the Atlantic coast, particularly from Maryland southward where at points they were the highest ever recorded in November.

Minimum temperatures over western districts were low for November, but in only a few cases, notably in California, were they below previous records. They were below zero from western Texas northeastward to the upper Lakes and thence westward to the Sierra Nevada and Cascade Mountains, the minimum reported being 36° below zero in North Dakota on the 27th, at which time the lowest temperatures of the month were recorded in most of the Mountain, Plateau, and Pacific States. East of the Mississippi, except in Wisconsin and Michigan, and locally in northern New England, minimum temperatures did not fall below zero and they were not lower than 20° in the Gulf or South Atlantic States, except in the higher mountains.

PRECIPITATION.

During the first few days of the month precipitation occurred in most eastern districts and also in the far Northwest, and toward the middle of the first decade rain or snow again fell over the northeastern districts and light rain was received in the far Northwest. Toward the latter part of the decade a precipitation area overspread the western Plateau States and moving eastward and northeastward, developed into a storm of wide extent by the end of the decade, and during the first few days of the second decade extended over most eastern districts. It brought unusually heavy rains in portions of the central Valleys and west Gulf States, and heavy snows in eastern Colorado and western Nebraska, and lighter falls over most northern districts from the Great Lakes westward. Throughout much of the second decade there were frequent rains or snows on the North Pacific coast and occasionally in the Lake region, but in the main fair weather prevailed.

About the beginning of the third decade precipitation occurred in the central Plateau districts, and locally in the Southwest during the following few days, and later in the decade light rain or snow was rather frequent from the region of the Great Lakes eastward and also in parts of the far Northwest. The last half of the decade was marked by much stormy weather and precipitation occurred in most sections of the country, except in the Southeast. Heavy rains occurred over the central valleys and portions of the far Southwest, and heavy snows were reported from the mountain districts of California, Utah, Arizona, and portions of adjoining States.

For the month as a whole the precipitation was heavy to excessive over a considerable area extending from the lower Mississippi Valley and northeastern Texas northeastward over the immediate Ohio Valley, where the general average was from 6 to 12 inches with local falls of from 15 to 18 inches. Heavy falls were also recorded in portions of Florida and in the higher elevations of the far Northwest, and some unusually large amounts for the season and region were received in northern Arizona. The month was dry in California, where only very light precipitation for the season occurred until near the end, except in portions of the mountain districts. Over the South Atlantic States, November was practically rainless, particularly over the eastern portions of the Carolinas and Georgia, and severe drought prevailed. Precipitation was deficient in the eastern Lake region, while from the upper Lake region and the Mississippi Valley southwestward to the Rocky Mountains the falls were mainly above the seasonal average, more than twice the monthly normal being received in many localities.

SNOWFALL.

Snowfall was heavy in the western mountain districts and also over the area from the upper Lakes to the Rocky Mountains, the ground being covered with snow during much of the month in these sections. At Houghton, Mich., more than 5 feet of snow fell during the month, and points in northern Arizona, southern Utah, and adjoining areas had unusually heavy snows toward the end of the month. In portions of the northern Plains and Rocky Mountains the ground remained snow-covered during practically the entire month, a condition that prevailed also during the last decade of October. The severe cold and lack of opportunity for range-grazing caused much suffering, and some loss of stock where provision could not be made for feeding or moving.

Over the eastern part of the country, the snowfall was generally light and but little remained on the ground at the end of the month save in extreme northern New England.

RELATIVE HUMIDITY.

From the Mississippi River westward to the Plateau region, the relative humidity was nearly everywhere above the normal, the excesses being quite large, particularly at the evening observation over the Missouri River and northern Mountain districts. Along the Pacific coast relative humidity was below normal, the deficiencies

being particularly large in northern California and southern Oregon. Over the districts from the Mississippi River eastward, the relative humidity was not far from normal but mostly slightly less, particularly over the south Atlantic coast.

Unusually low relative humidity was observed over the Florida Peninsula on the 18th and 19th, the values were lowest over the northern districts on the 18th and over the extreme southeast on the 19th, the lowest observed was 22 per cent at Miami. These readings were in connection with a low barometer off the east Florida coast which caused strong northwest winds over the mainland, but this evidently did not wholly produce the low moisture content of the air, as inland stations farther north had much higher values of both relative and absolute humidity.

SAND STORMS.

At the U. S. Naval air station, San Diego:

November 21 and 22, sand storms came up, reaching their greatest violence about noon each day, with a maximum wind velocity of about 50 miles per hour, and the bumpiest air conditions at all altitudes experienced at this station during the current fiscal year.

Average accumulated departures for November, 1919.

Districts.	Temperature.			Precipitation.			Cloudiness.		Relative humidity.	
	General mean for the current month.	Departure for the current month.	Accumulated departure since Jan. 1.	General mean for the current month.	Departure for the current month.	Accumulated departure since Jan. 1.	General mean for the current month.	Departure from the normal.	General mean for the current month.	Departure from the normal.
	°F.	°F.	°F.	In.	In.	In.	0–10.		P. ct.	
New England	40.1	+1.1	+17.0	3.92	+0.40	+ 2.31	6.9	+0.8	78	+ 2
Middle Atlantic	45.8	+1.5	+26.4	2.72	−0.20	− 2.90	5.7	+0.3	74	0
South Atlantic	57.4	+3.3	+21.9	0.59	−2.20	− 7.90	5.0	+0.6	73	− 3
Florida Peninsula	73.5	+2.5	+ 3.5	3.73	+1.50	+ 4.20	4.6	+0.4	75	− 5
East Gulf	59.9	+4.4	+15.0	4.28	+0.70	+ 9.46	5.3	+0.8	77	+ 2
West Gulf	57.4	+1.0	−2.0	3.83	+0.80	+10.45	5.0	+0.3	77	+ 4
Ohio Valley and Tennessee	45.5	+0.9	+20.4	4.61	+1.20	+ 3.40	5.6	0.0	75	+ 2
Lower Lakes	38.8	−0.3	+22.4	1.57	−1.40	+ 0.30	7.4	+0.1	74	− 2
Upper Lakes	32.9	−1.4	+29.8	3.32	+0.90	− 1.40	7.5	+0.4	79	− 1
North Dakota	15.8	−8.7	+11.7	1.08	+0.30	− 2.15	5.5	0.0	85	+ 6
Upper Mississippi Valley	36.9	−0.9	+21.7	3.18	+1.20	+ 3.10	6.1	+0.6	75	+ 1
Missouri Valley	34.9	−2.5	+18.2	2.62	+1.40	− 1.50	5.6	+0.7	76	+ 6
Northern slope	25.4	−6.7	+11.1	1.44	+0.60	− 1.70	5.2	+0.1	74	+ 5
Middle slope	39.2	−2.6	+ 5.8	1.60	+0.60	− 3.33	4.3	+0.3	71	+ 8
Southern slope	49.4	−1.5	−11.0	1.55	+0.40	+ 0.60	4.8	+0.4	70	+ 4
Southern Plateau	48.4	−0.5	+2.2	0.87	+0.30	+ 1.59	3.0	+0.2	53	+ 5
Middle Plateau	37.1	−2.5	+3.4	0.82	−0.10	− 2.40	3.9	−0.4	60	− 1
Northern Plateau	36.5	−2.2	+7.9	2.00	+0.60	− 2.10	6.5	+0.4	75	+ 4
North Pacific	44.9	−0.7	+6.7	6.39	−0.60	− 7.20	8.0	+0.4	85	− 1
Middle Pacific	52.0	−1.0	−7.2	0.88	−2.30	− 5.10	3.3	−1.4	59	−16
South Pacific	57.4	−0.2	+4.1	0.27	−1.00	− 4.70	2.0	−2.4	56	−11

Winds of 50 mi./hr. (22.4 m./sc.), or over, during November, 1919.

Station.	Date.	Velocity.	Direction.	Station.	Date.	Velocity.	Direction.
Block Island, R. I.	5	69	nw.	Mount Tamalapais, Calif.—Con.			
Do.	6	54	nw.	Do.	26	84	n.
Do.	30	52	w.	Do.	27	88	n.
Buffalo, N. Y.	4	54	w.	Do.	28	52	n.
Do.	11	54	w.	Do.	30	56	nw.
Do.	12	52	w.	Nantucket, Mass.	5	54	ne.
Do.	14	56	sw.	Nashville, Tenn.	29	55	se.
Do.	18	50	w.	New York, N. Y.	4	50	nw.
Do.	22	56	sw.	Do.	5	59	nw.
Do.	29	76	sw.	Do.	6	61	nw.
Do.	30	82	sw.	Do.	19	58	nw.
Burlington, Vt.	11	52	s.	Do.	20	60	nw.
Cairo, Ill.	29	56	sw.	Do.	30	58	nw.
Canton, N. Y.	29	57	sw.	North Head, Wash.	4	52	nw.
Do.	30	53	w.	Do.	5	52	se.
Cheyenne, Wyo.	1	52	w.	Do.	6	50	se.
Do.	2	66	w.	Do.	7	54	nw.
Chicago, Ill.	10	50	sw.	Do.	15	68	s.
Do.	29	50	sw.	Point Reyes Light, Calif.	2	51	nw.
Cleveland, Ohio.	29	60	w.	Do.	3	50	nw.
Columbus, Ohio.	29	52	s.	Do.	4	50	nw.
Do.	30	50	w.	Do.	7	73	nw.
Dayton, Ohio.	29	56	sw.	Do.	19	67	nw.
Detroit, Mich.	29	87	sw.	Do.	26	64	nw.
Duluth, Minn.	29	53	nw.	Do.	27	61	n.
Eastport, Me.	5	72	ne.	Port Huron, Mich.	29	76	w.
Do.	6	56	ne.	Providence, R. I.	5	52	nw.
Ellendale, N. Dak.	10	66	nw.	Do.	30	55	w.
Erie, Pa.	29	54	s.	Saginaw, Mich.	29	53	sw.
Do.	30	54	sw.	Sandusky, Ohio.	29	68	sw.
Evansville, Ind.	29	67	sw.	Do.	30	54	sw.
Fort Wayne, Ind.	29	66	sw.	Sandy Hook, N. J.	5	64	nw.
Grand Haven, Mich.	29	56	sw.	Do.	6	50	nw.
Green Bay, Wis.	10	56	sw.	Do.	30	50	sw.
Do.	29	50	sw.	San Francisco, Calif.	26	60	n.
Indianapolis, Ind.	29	58	sw.	Do.	27	62	ne.
Keokuk, Iowa.	10	63	sw.	Sioux City, Iowa.	10	52	w.
Louisville, Ky.	29	58	sw.	St. Louis, Mo.	29	64	sw.
Lexington, Ky.	29	62	sw.	St. Paul, Minn.	10	50	s.
Ludington, Mich.	10	54	sw.	Syracuse, N. Y.	29	52	s.
Mount Tamalapais, Calif.	2	50	nw.	Tatoosh Island, Wash.	3	60	e.
Do.	4	72	nw.	Do.	11	53	e.
Do.	5	58	nw.	Do.	14	58	s.
Do.	7	64	nw.	Do.	15	64	s.
Do.	8	50	n.	Do.	16	61	s.
Do.	18	64	nw.	Toledo, Ohio.	29	82	sw.
Do.	19	62	nw.	Do.	30	57	sw.
Do.	20	58	n.				
Do.	25	74	nw.				